Using Microsoft Word to Teach Area

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describes how readily available software may be used to help children develop better understanding of area.

Background

As a Year 5 teacher in an outer suburb of Melbourne I am constantly looking for ways of integrating technology into all aspects of my teaching to motivate students and to enhance their learning experiences. My goal this year has been to explore different uses of technology in mathematics. It has been my observation that whilst working with inquiry-based topics and literacy, technology is far more easily and naturally incorporated.

A number of underlying principles for including technology in the mathematics classroom is provided by Way and Webb (2006). They see technology, if incorporated in a rich and meaningful way, as potentially providing:

- a shift from 'instructivist' to constructivist education philosophies;
- a move from teacher-centred to student-centred learning activities;
- a shift from a focus on local resources to global resources; and
- an increased complexity of tasks and use of multi-modal information (Way & Webb, 2006).

It is my intention to show these principles in action, in the following lesson sequence.

My attempts to allow students the opportunity to experience mathematics through the lens of technology have provided the class with periods of excitement, curiosity

and apprehension. In addition to affecting the way in which lesson content has been delivered, this process has also led to me taking further studies in using technology when teaching mathematics.

My class and I have used technology including spreadsheets, virtual manipulatives, learning objects and applets to explore various concepts in mathematics. For example, students in my class created an Excel spreadsheet that allowed them to quickly divide and multiply whole and decimal powers of ten, thus allowing them to gain a better understanding of place value, and the processes involved.

A colleague provided me with a lesson plan that involves teaching area using Microsoft Word (2007). Throughout my studies over the semester, I had been exposed to many different programs and applications. I had been introduced to various software and applets that would assist my students in achieving many required understandings. The element of this lesson that captured my imagination was the idea that I might be able to use as generic and universal an application as Microsoft Word to assist my students in developing the fundamental concept of area.

The lesson: Setting the scene

The lesson was introduced by asking a series of 'tuning in' questions. The first involved asking students for their definition of 'area'. The initial responses to this question were of concern. One student replied, "Area equals length times width." I then suggested that he/she had provided me with purely a method of calculating the area of a rectangle. Another eager child suggested the "area of a triangle equals half base times height". While this statement of mathematical fact impressed me, the response I was seeking still remained elusive. Finally, a student suggested that 'area' could be described as "the space within a shape".

I then went on to ask for different strategies to find the area of an irregular shape. One student suggested that we might use string to measure the outside length of the shape. Another student disputed this claim and suggested that this method would allow us to find the 'perimeter' but would not be of great help when attempting to find the 'area'. Muffled sounds of agreement could be heard following the latter statement. The fact that class members were volunteering their ideas and having them evaluated by other class members, without my intervention, was evidence that the lesson had gone from a teacher-centred activity to a student-centred learning activity.

A student then offered another description of how one might work out the area of an irregular shape. They stated that by breaking a shape into a series of rectangles, then by using the "Area = length × width" formula to work out the area of these smaller rectangles and finally adding the combined area, the desired result would be achieved. This response again indicated a great deal of thought and an excellent ability to extrapolate. However, I then indicated to the students that the described method was usually only useful when the shape under consideration was composed of straight edges and right angles.

I suggested overlaying a grid on an irregular shape to determine the area of any irregular shape. This related to the original way my students would have been introduced to 'area' in prior years. They would have drawn a grid of rows and columns to match the dimensions of the shape and then counted the 'squares' to determine the area of the shape. In the 'tuning-in' question time, none of the students had considered this way. In the intervening time since they had been introduces to area, the students had reduced 'area' to a formula and had lost an understanding of the real meaning of the concept.

This should not have surprised me as research by Mulligan, Prescott, Mitchelmore, and Outhred (2005) stated:

A structure that is important in area measurement is the grid that results when you divide a rectangle into square units. For young children, it is not easy to construct this grid. They do not seem to recognise the pattern formed when a rectangle is tiled using equal sized squares. Recognition of this structure is a necessary step in understanding how area is measured using square units and, in particular, how area measurement is related to multiplication.

Using technology

Our class went to the school's computer lab, where each student had access to a laptop. The computer lab is also equipped with an interactive whiteboard. On the whiteboard were the instructions for the activity:

Working out the area of a clipart image

The following instructions will allow you to calculate the area of a clip art image.

1. Start Microsoft Word (if there is no icon on the desktop, it is in the “Start” menu under Microsoft Office).
2. Open a blank document.
3. Use the tool bar at the top of the page. Click ‘Insert’. Then click ‘picture’. Then click ‘Clip Art’.
4. Choose a picture that you would like to find the ‘area’ of (the more ‘regular’ the shape of the picture, the easier it will be to calculate the area).

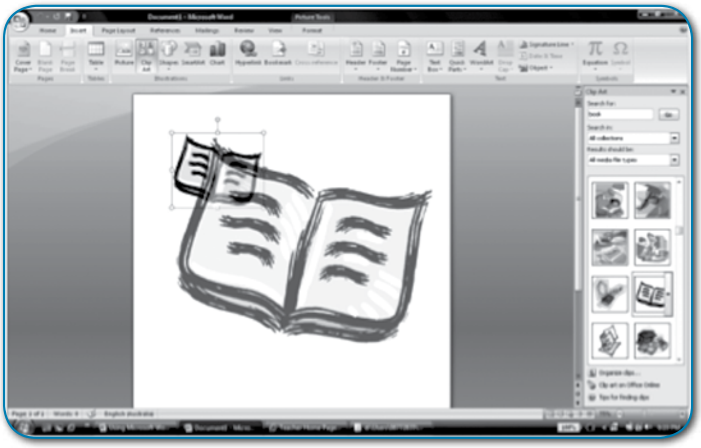

Figure 1. Resizing a picture.

5. Use the arrows and circles to resize your picture until it fills your page (see Figure 1). Once finished, ensure that the picture is not still selected.
6. Click on ‘Insert’. Then click on table. Create a table with 18 rows and 18 columns. Ensure that you have selected a fixed column width of 1 cm (see Figure 2).

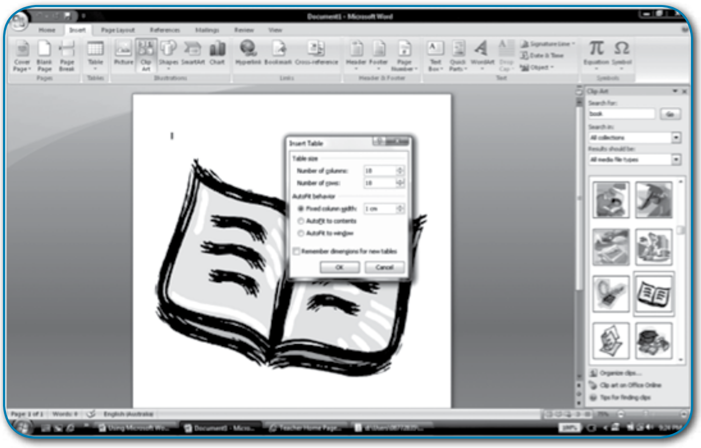

Figure 2.

7. Highlight your table. Then right click. At the bottom of the options click ‘table properties’.
8. Click on the ‘row’ tab.
9. Specify the height as 1 cm. Your table now is made up of a 1 square cm grid.
10. Move your picture on top of your grid.
11. Right click on your picture and click “send behind text (displayed below). You may need to do this using the toolbar that is located in “page layout” called “text wrapping”.

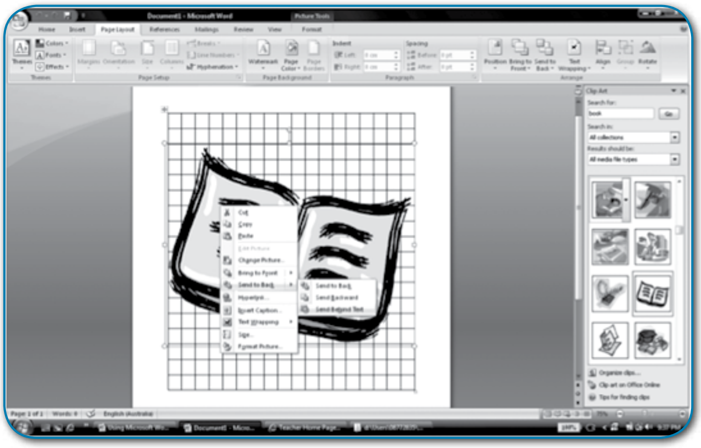

Figure 3.

12. If your image has a 1 cm × 1 cm grid overlayed on top of it (like the one shown in Figure 4), congratulations, you have succeeded and may print out your work.

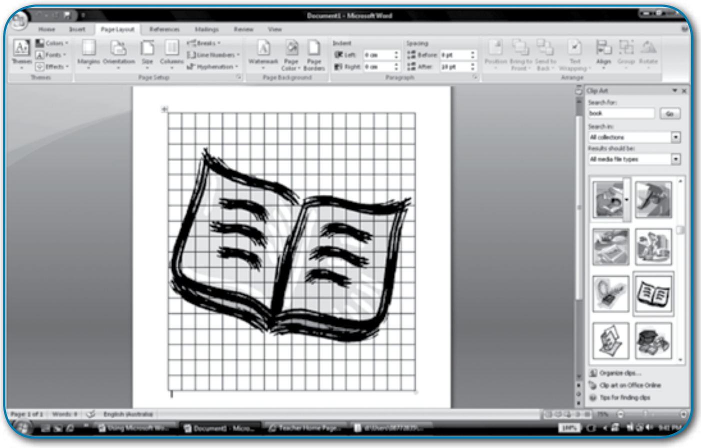

Figure 4.

The class undertook this activity in conjunction with me. While I went through the process on the interactive whiteboard, the students mirrored my actions. At the conclusion of the given instructions, all students had successfully performed the task.

Computers were then shutdown and, after each student had collected their work from the printer, we returned to our classroom, where again the students were asked: "How can we work out the area of these irregular shapes?"

Immediately, a class full of hands appeared in the air. All of the students now understood that by overlaying a grid on an irregular shape we could find the area.

One difficulty remained for students. As a result of the irregular nature of the shapes that were being studied, many of the squares on the perimeter of their shapes were only partially filled. This left students considering various strategies for compensating for this problem in their calculations. Some students took a fairly rudimentary approach whereby they counted the number of squares on the perimeter and divided the total by two. They then added all of the inside squares to this number. Others categorised 'border squares' as either one quarter, half, or three quarters filled. They then took these figures into account when calculating their total area. Some students expanded on the second strategy by attempting to determine what 'tenth' of the square was filled and eventually producing their own findings.

Conclusion

A series of principles by which the use of technology in the mathematics classroom can be measured were previously stated (Way & Webb, 2006). To conclude, a reflection based on how the described lesson adheres to these principles will be provided.

With careful use of scaffolding, the lesson did allow for the students to construct their own knowledge of the content. This was visible when students were able to construct ways of finding the area of shapes through discussion. It is also through students constructing their own knowledge that they were able to develop a more conceptual understanding of what area actually is. Throughout the entire lesson sequence little mention was made of algorithms. In this way Tracey Muir's belief that "introducing the area formula before students have had opportunities to develop a conceptual understanding of area and to see the usefulness of arrays could be counter-productive to developing sound measurement sense" (Muir, 2006) was also catered for. This constructivist approach to teaching also meant that rather than being teacher-centred the lesson content was student-centred.

Microsoft Word is a fairly standard piece of software. Therefore, the stated activities could take place in classrooms across the world. This addresses Way and Webb's third principle. The fact that students were considering area using a computer and software package is also a multi-modal approach.

Students were able to approach the task in a more or less sophisticated way, depending on their level of ability. This was evident in the different strategies students used to obtain more or less accurate statements about

the area of an irregular clip art. The open-ended nature of the task provides evidence of increased complexity and allows for higher order thinking skills. All students were able to achieve a high level of success as a result of this.

In addition to helping provide the learning and pedagogical outcomes suggested by Way and Webb, I believe that technology helped to provide a number of other key ingredients in this lesson, the first of which was a greater level of engagement due to the innate attractiveness that technology represents. Students also felt a high degree of ownership over their work. The lesson was individualised because they were able to select their own clip art image. Finally, the immediacy with which students were able to overlay the grid over the image provided students with a better connection to the activity.

Acknowledgement

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References

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